

DNA Structure & Replication Webquest

Name _____

Website: http://www.phschool.com/science/biology_place/biocoach/dnarep/nucleotide.html

Link is also available on wikispace, unit 3 under "DNA online activities"

Concept 1 – The Nucleotide

The basic _____ of _____ is the _____.

The nucleotide in DNA consists of a _____, one of _____ (cytosine _____, thymine _____, adenine _____, guanine _____, and a _____). Cytosine and thymine are _____ bases, while adenine and guanine are _____ bases. The sugar and the base together are called a _____.

Sugar

The sugar is the _____-carbon sugar _____. By convention the carbons on this sugar are labeled _____.

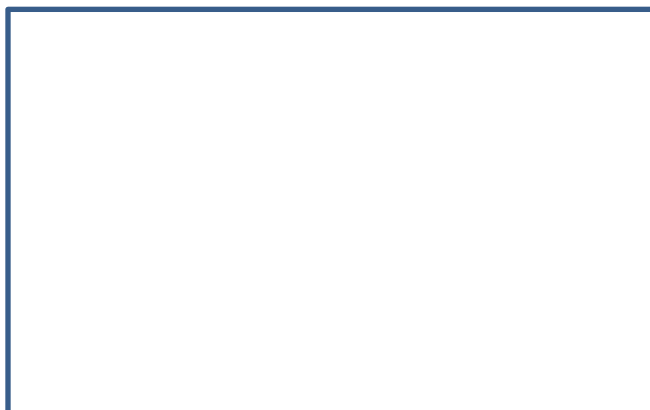
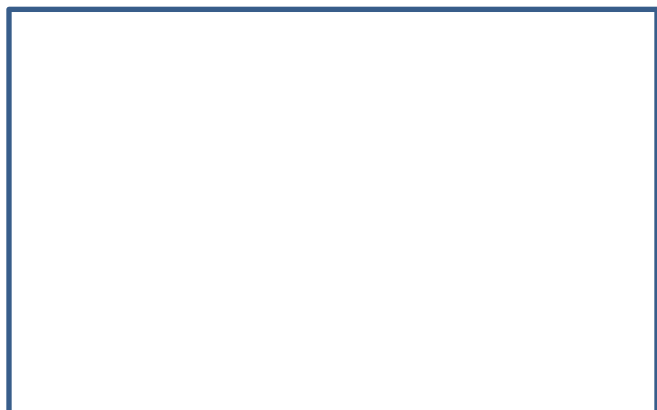
Phosphate

The phosphate is attached to the _____ of the deoxyribose _____.

Base

The base is attached to the _____ of the deoxyribose _____. There are four different bases found in DNA. Because each base contains at least two nitrogen atoms, they are called nitrogenous bases. There are two _____ of bases, the pyrimidines (_____)), and the purines (_____).




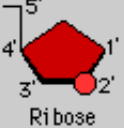

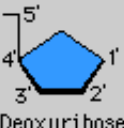


Draw the full structure for a purine nucleotide and a pyrimidine nucleotide below, labeling all parts of the sugar, base & phosphate.



Complete the practice for concept 1 by filling it in below.

Assemble a Nucleotide

In the interactive below, use the biological molecular components common in a typical cell to assemble a DNA pyrimidine nucleotide in the box at the right.

 Amino acid	 Fatty acid	 Base	
 Ribose		 Base	
 Deoxyribose	 Phosphate	 Base	

Explain which parts above do not belong and why.

Concept 2: The DNA Double Helix

DNA consists of two _____ chains wound around each other to form a _____. Each polynucleotide chain consists of a string of nucleotides linked by _____.

A DNA chain consists of nucleotides joined by bonds between _____ and _____ (= phosphodiester bonds). One end of the chain ends with a _____ linked to the 5' carbon of the _____ and is called _____. The other end of the chain ends with an hydroxyl group linked to the _____ of the sugar and is called the _____.

The two chains of DNA strands are held together by _____;

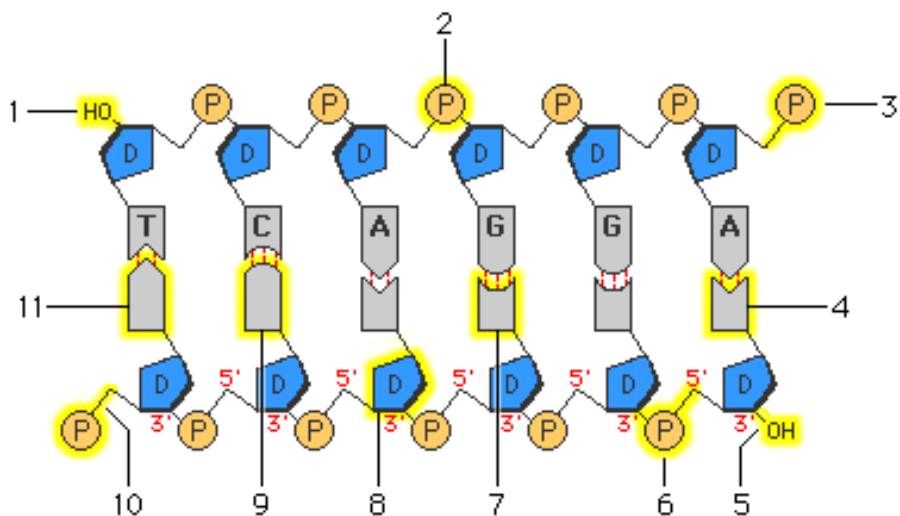
that is, specific bonding between _____ bases and between _____ bases on the two strands.

To make a _____ double helix, the two strands of DNA are _____; that is, the _____ direction of one strand runs _____ to the other strand.

In _____ base pairing, the two DNA chains are held together by hydrogen bonds between _____ (_____) and _____ (_____).

Complete the practice for concept 2 by filling it in below. Use the word-bank below.

Label DNA Strands



1. <input type="text"/>	7. <input type="text"/>
2. <input type="text"/>	8. <input type="text"/>
3. <input type="text"/>	9. <input type="text"/>
4. <input type="text"/>	10. <input type="text"/>
5. <input type="text"/>	11. <input type="text"/>
6. <input type="text"/>	

Adenine	Guanine	Cytosine	Thymine	3' end (can repeat)	5' end (can repeat)
Deoxyribose		Phosphodiester Bond		Phosphate	

Concept 4: Biosynthesis of DNA

In the practice below:

1. Draw in what the correctly base-paired DNA strand would look like, using the template for guidance and the choices underneath to choose from for the building blocks.
2. Explain why your chosen building blocks will not look the same once they have been bonded in their correct location.

3. For any building blocks not used, explain why they were incorrect choices.

Match the nucleotides to the template strand as DNA polymerase would.

The diagram shows a DNA template strand at the top with bases T, C, A, C, G from left to right. The 3' end is on the left and the 5' end is on the right. Below the template is a light blue box containing ten nucleotide choices. Each choice consists of a phosphate group (P), a deoxyribose sugar (D or R), and a nitrogenous base (G, A, U, C, T). The bases in the choices, from left to right, are: G, G, A, A, A, A, U, C, C, T. The sugar is D for G, A, C, T and R for U. The phosphate groups are represented by yellow circles with 'P'.

Concept 5: Replicating Antiparallel DNA Strands

The two DNA strands are _____, yet DNA polymerase can only synthesize new DNA in the _____ direction. This poses special problems for replicating double-stranded DNA.

Click on each step: [watch the animation](#) & fill in the information below.

Step 1

1. The DNA is already partially unwound to form a _____.
2. On the bottom template strand, _____ synthesizes a short _____ in the _____ direction.
3. Primase leaves, and _____ adds DNA nucleotides to the RNA primer in the _____ direction. This new DNA is called the _____ because it is being made in the _____.

Step 2

1. On the top _____ strand, primase synthesizes a short RNA primer in the _____ direction.
2. Primase leaves, and DNA polymerase adds DNA nucleotides to the _____ in the 5' to 3' direction. This new DNA is called the _____ because it is being made in _____. The _____ produced is also called an _____.

Step 3

1. The DNA _____ some more and the _____ is extended by _____ adding more DNA nucleotides. Thus, the leading strand is _____.

Step 4

1. On the top template strand, a _____ is synthesized by _____ near the _____ and DNA is added to it by DNA polymerase. This produces the _____ Okazaki fragment. Thus, the _____ is synthesized _____.
2. DNA _____ the two _____ to produce a _____ chain.
3. The process _____ as the DNA continues to _____. Because one new DNA strand is synthesized continuously and the other is synthesized discontinuously, this model is called the _____ model for DNA synthesis.

Step 5

1. A different type of DNA polymerase _____ and replaces it with _____.

9. _____

10. _____

11. _____

12. _____

Activity & Notes Quiz: Complete on the back of this page.

Questions 1 – 4 Write **leading strand**, **lagging strand**, or **both**

1. Requires the enzyme primase _____
2. Requires Okazaki fragments _____
3. Requires DNA polymerase _____
4. Grows continuously _____
5. A nitrogen base containing 2 fused nitrogen rings is classified as a _____
6. The _____ end of a DNA molecule always has an exposed hydroxyl group.
7. If the percentage of Thymine is 35%, how much Guanine is present? _____%
8. Starting with 1 molecule of DNA, what fraction of original DNA would be present in a sample after 2 rounds of replication? _____
9. The name for the monomer in DNA replication is _____
10. DNA always elongates in the _____ → _____ direction.
11. Prokaryotes have how many origins of replication? _____
12. The shape of prokaryote DNA is _____ but the shape of eukaryote DNA is _____
13. A virus that interferes with RNA sequences would impact the _____ strand the most.
14. _____ bonds hold together a sugar-phosphate backbone but _____ bonds hold together the double helix.
15. The enzyme _____ unwinds a DNA double helix.